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Soviet Statistics on Capital Formation

A Reference Aid

SOV 82-10093
August 1982

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Errata

Notice to recipients of Soviet Statistics on Capital Formation, SOV 82-10093, August 1982.

1. Table 4 (page 6):

Under the heading "Gross fixed investment in agriculture--entire complex of works," the subheadings "productive" and "nonproductive" are not components of "collective farms" as shown. Rather they are a separate breakdown of the major heading "Gross fixed investment in agriculture--entire complex of works."

2. Table 7 (page 10):

The column head UC_{t-1} should read $UC_{t-1} - UC_t$.

3. Text table (page 12):

The second column head should read "CIA: Producer Durables Production" vice "CIA: Producer in Durables Production."

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Soviet Statistics on Capital Formation

Introduction

This report presents a compilation of statistics on fixed capital assets and capital investment in the Soviet Union. Included are estimates of the value of *fixed capital* (a stock concept) as well as estimates of fixed *capital investment* (a flow concept)—both series by sector of the economy and by branch of industry. In addition, data are presented for gross additions to capital and utilization of national income for accumulation, retirement rates of the Soviet capital stock are estimated, and values of unfinished construction are given for various sectors of the Soviet economy. All the data are given in constant prices with the exception of the series on unfinished construction and on utilization of national income for accumulation.

These statistics were constructed from official data published by the Soviet Government. Specifically, the sources used were annual issues of the Soviet statistical handbook *Narodnoye khozyaystvo* (hereafter cited as *N.kh.*) and annual issues of the CEMA economic handbook *Statisticheskiy yezhegodnik stran-chlenov soveta ekonomicheskoy vzaimopomoshchi* (hereafter cited as the CEMA handbook). The methods used to construct each data series are documented in footnotes appended to each table and in an appendix describing the methodology used to convert data from one price base to another.

The statistics in this report might be questioned on two counts. First, there is the general consideration of whether data based entirely on official Soviet statistics can be trusted. Second, there is the more specific concern that the Soviet constant price investment series take inadequate account of inflation and thus exaggerate the amount of investments.

Neither of these doubts can be dispelled completely. Nevertheless, the available evidence suggests that the Soviet data do not suffer from serious distortion. Doubts about the reliability of the Soviet investment series—apart from inflation—have been largely allayed by Western economists, notably Norman Kaplan, Richard Moorsteen, and Raymond Powell. They have compared estimates of the Soviet capital stock obtained independently—by a perpetual inventory method—with the results of the 1960 and

Information available as of 1 April 1982 has been used in the preparation of this report.

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1973 Soviet censuses as well as with the annual indexes of the capital stock published for intervening years. They found the correspondence between the official data and their own estimates to be quite close. For example, whereas the official index of the gross fixed capital stock implies an annual growth rate over the 13-year period of 8.4 percent, the perpetual inventory indexes implied a growth rate of 8.0 to 8.3 percent. Moreover, a similarly close correspondence was found for years extending back from the early 1960s to 1928.[1]

In addition, the reliability of the Soviet data was tested in this study (see p. 9). One measure of their reliability is the degree to which the various statistical series published by the Soviets are consistent with each other because they should all be interrelated. Our analysis found the data to be reasonably consistent.

Arguments on both sides of the inflation debate are presented in the final part of this study. Our assessment is that (a) while inflation in construction and machinery cannot be established with any degree of certainty, it probably is mild—2 percent annually at most—and (b) the Soviets may well be deflating more or less accurately the current price series for these categories.

[1] See Richard Moorsteen and Raymond P. Powell, *The Soviet Capital Stock, 1928-1962* (Homewood, Illinois: Richard D. Irwin, Inc.) and Raymond P. Powell, "The Soviet Capital Stock From Census to Census, 1960-1973," *Soviet Studies*, XXXI (January, 1979), pp. 56-75. The fact that the official Soviet series and the Moorsteen-Powell estimates give very similar results does not exclude the possibility that both series may embody some inflation. This is true because the constant "estimate prices" used in both the capital stock censuses and in enterprise accounts may in fact include some price inflation.

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Gross Fixed Capital

The principal sources of information on the capital stock in the Soviet Union are the official capital censuses undertaken periodically by the Soviet Government. A census was carried out in 1959 and 1960. At that time the fixed capital on hand as of 1 January 1960 (excluding that on collective farms) was surveyed and revalued in 1955 prices. For a discussion of the 1959-60 census, see Norman M. Kaplan, "Capital Stock," A. Bergson and S. Kuznets (eds.), *Economic Trends in the Soviet Union* (Cambridge, Mass: Harvard University Press, 1963), pp. 96-149, and Richard Moorsteen and R. P. Powell, *The Soviet Capital Stock, 1928-1962* (Homewood, Ill: Richard D. Irwin, Inc., 1966).

Another census was undertaken in 1971 and 1972. At that time, the stock of fixed capital on hand as of 1 January 1972 (for budget organizations, the stock of capital on hand as of 1 January 1973) was surveyed and revalued at replacement cost determined on the basis of 1969 estimate prices.[2] The stock of private housing was an exception; values formerly declared to be in 1955 prices were now declared to be in 1973 prices. Subsequent adjustments were made for new wholesale prices for equipment introduced on 1 January 1973. The 1971-72 census was a large and elaborate effort, involving 1.5 million enterprises and organizations, over 5 million workers, and 180 million distinguishable assets. For its execution, the Central Statistical Administration prepared 222 handbooks, 172 for the evaluation of equipment and 50 for structures. For a discussion of the 1971-72 census, see Raymond P. Powell, "The Soviet Capital Stock From Census to Census, 1960-1973," *Soviet Studies*, vol. XXXI, No. 1 (January 1979), pp. 56-75.

Data on the value of the capital stock for noncensus years expressed in "comparable prices" are published in index form in the annual issues of *Narodnoye khozyaystvo*. The source of the official indexes is obscure. Powell presents evidence suggesting that the indexes are based on reports submitted annually by enterprises of the capital on their books. Little is known, however, about the source and nature of the deflators used.[3]

The Soviet definition of fixed capital (*osnovnye fondy*) includes the undepreciated value of buildings, structures, conveying equipment, machinery and equipment (operating and power machinery and equipment, measuring and control instruments and devices, laboratory equipment, computer hardware), vehicles, tools, and productive and draft livestock of basic herds (excluding young livestock, livestock allocated for fattening, and some minor categories such as poultry, rabbits, and fur-bearing animals). Fixed capital is broken down into "productive" and "nonproductive" capital. In Marxist parlance, productive capital is used directly in the production process.[4] Nonproductive capital includes capital in the housing and municipal services sector and in organizations and institutions of public health, education, science, culture, art, credit institutions, and administrative organs.

[2] Estimate prices are those used for project estimates and for planning and reporting purposes. Cost estimating prices indicate the value of normed input requirements and purchased equipment plus normed overhead charges, where wages are reckoned at prevailing rates of the indicated year and materials inputs and equipment at wholesale transfer prices of the indicated year. Values at estimate prices differ, therefore, from actual investment outlays of the indicated year insofar as actual input consumption, overhead outlays, and distribution costs differ from the corresponding norms. See Richard Moorsteen and Raymond P. Powell, *The Soviet Capital Stock, 1928-1962* (Homewood, Illinois: Richard D. Irwin, Inc., 1966), p. 187.

[3] See Powell, *op. cit.*, p. 66.

[4] In practice this obviously leads to compromise in difficult accounting situations. For example, freight transportation and communications serving production are viewed as *productive* activities while passenger transportation and communications serving the public are considered *nonproductive*. The capital stock data published in the annual issues of *N.kh.*, however, categorize all transport and communications capital assets as productive—probably because of the practical difficulty of clearly delineating and separating out the two types of activities. Less frequently published data such as the input-output tables, on the other hand, do make this differentiation.

The statistics on Soviet gross fixed capital stock shown are presented by sector of the economy (table 1) and by branch of industry (table 2); all values are expressed in constant 1973 prices. The specific sources and methods used to construct the data series are explained in the footnotes to the tables.

Gross Fixed Capital Investment

In general terms, fixed capital investment is a measure of a nation's yearly expenditure on reproducible fixed assets—machinery and production facilities—as part of the process of undertaking new projects and continuing and completing existing projects. Gross fixed capital investment includes net capital formation plus depreciation. It may or may not include expenditures on capital repairs depending upon the convention adopted by individual countries. The Soviet definition of capital investment (*kapital'nye vlozheniya*) excludes capital repairs; [5] it includes outlays for new construction, for reconstruction, expansion and reequipment of existing industrial, agricultural, transportation, trade and other enterprises, as well as outlays for construction of housing, municipal service facilities, and facilities for rendering cultural and everyday services to the public.

Soviet gross fixed capital investment includes outlays for construction work, including assembly of structural elements which become part of the structure of a building; outlays for the work of installing equipment; outlays for the drilling of producing and exploratory petroleum and gas wells; outlays for equipment whether requiring installation or not; outlays to acquire production tools and equipment for maintenance and upkeep; outlays for survey work in the project planning stage; outlays for other operations classified among capital investments, and miscellaneous outlays.

Not included in Soviet gross fixed capital investment are expenditures for the following: geological exploration; design work for cities, urban settlements, and for planting forests and forest belts; foundation herds; equipment for existing government institutions, schools, hospitals, kindergartens, and day nurseries; and major repairs of buildings and installations, equipment, vehicles, and other fixed assets.

The statistics on gross fixed capital investment in the USSR are presented by sector of the economy (table 3). The investment series for the agricultural sector is then singled out and broken down in various ways (table 4). Finally, the industrial investment data are presented by individual branches of industry (table 5). The data on gross fixed capital investment presented in tables 3 through 5 are given in 1973′ prices to differentiate them from the 1973 price base of the gross fixed capital stock data presented in tables 1 and 2. The gross fixed capital investment data for plants are given in 1969 estimated prices, adjusted for reduced construction-installation coefficients introduced on 1 January 1976. For producer durables, the data are given in 1969 estimate prices, adjusted for new wholesale prices introduced on 1 January 1973. Overall, in terms of prices the investment data are probably as comparable as possible to the statistics on the gross fixed capital stock, but some differences may still exist, hence the designation "1973′ prices." [6] The specific sources and methods used to construct the data series are explained in the footnotes to the tables.

Changes in Capital Stock and Investment in Process

In addition to publishing data on the value of fixed capital stock and gross fixed capital investment, the Soviet Government publishes several other statistical series relating to capital formation. These data are compiled and presented in table 6. All of the data on capital formation published by the Soviet Government should, theoretically, be interrelated and logically consistent. Indeed, determining the consistency of the data is an important issue because the statistical series are used in the West to assess the efficacy of Soviet investment policies in particular and the performance of the Soviet economy in general. Consequently, this report discusses testing of the consistency of the published data. Finally, some brief comments on the impact of wholesale price inflation in the USSR on official investment statistics follow.

[5] In Soviet practice maintenance expenditures fall into two categories—current and capital repairs. Current repairs, which are financed as a component of production costs, cover preventive maintenance and routine servicing of machinery and equipment. Capital repairs, which are financed out of amortization allowances, involve major renovating outlays to replace defective or worn parts of existing assets.

[6] For a discussion of how the Soviets estimate construction costs, see Research Aid ER76-10068 (Unclassified), February 1976, *Ruble-Dollar Ratios for Construction.*

Table 1

Billion Rubles, 1973 Prices

Gross Fixed Capital by Sector of the Economy, 1949-80 [a]

	End of Year												End of Year												End of Year									
	~~1949~~ 1950	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959		1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total gross fixed capital																																		
(Including livestock)	**150**	**161**	**174**	**186**	**205**	**227**	**251**	**276**	**303**	**334**	**365**		**398**	**433**	**471**	**513**	**556**	**601**	**645**	**691**	**740**	**795**	**860**		**929**	**1,006**	**1,084**	**1,170**	**1,256**	**1,345**	**1,437**	**1,537**	**1,637**	~~1,744~~
(Excluding livestock) [b]	**137**	**147**	**160**	**171**	**191**	**213**	**236**	**260**	**286**	**314**	**345**		**378**	**412**	**449**	**490**	**533**	**578**	**621**	**667**	**715**	**769**	**836**		**904**	**981**	**1,057**	**1,143**	**1,230**	**1,318**	**1,410**	**1,509**	**1,609**	**1,715**
Productive																																		
(Including livestock)	82	89	97	104	116	130	144	157	172	188	206		226	249	273	301	329	360	390	419	452	489	531		573	627	680	743	805	868	932	1,004	1,074	~~1,149~~
(Excluding livestock) [b]	69	75	83	89	102	116	129	141	155	168	186		206	228	251	278	306	337	366	395	427	463	507		548	602	653	716	779	841	905	976	1,046	1,120
Industry	30	33	37	41	46	52	59	65	72	80	89		100	112	125	140	153	168	183	197	214	233	255		278	301	326	354	385	416	445	480	514	~~551~~
Agriculture																																		
(Including livestock)	24	26	28	30	31	33	36	39	43	48	51		54	58	63	68	72	77	82	87	93	98	106		116	126	140	154	167	180	194	209	223	238
(Excluding livestock) [b]	11	12	14	15	17	19	21	23	26	28	31		34	37	41	45	49	54	58	63	69	74	82		91	101	113	127	141	153	167	181	195	209
(Livestock) [b]	13	14	14	15	14	14	15	16	17	20	20		20	21	22	23	23	23	24	24	25	26	24		25	25	27	27	26	27	27	28	28	29
Transportation and communications	22	23	24	25	28	32	36	39	42	45	49		54	59	64	70	75	83	89	95	101	109	117		126	137	147	159	171	182	195	209	223	~~239~~
Construction	2	2	3	3	4	4	5	5	5	5	6		7	8	9	10	11	12	14	15	17	20	22		24	27	30	33	35	39	43	48	52	55
Trade, public dining, material-technical supply, procurement, and other branches of material production [c]	4	5	5	5	7	9	8	9	10	10	11		11	12	12	13	18	20	22	25	27	29	31		29	31.1	36	37	43	47	51	55	58	62
Nonproductive	68	72	77	82	89	97	107	119	131	146	159		172	184	198	212	227	241	255	272	288	306	329		356	379	404	427	451	477	505	533	563	~~595~~
Housing	54	57	59	62	67	72	78	86	94	103	111		120	128	136	144	151	159	166	175	184	194	204		214	226	239	253	267	280	294	309	323	~~338~~
Services (communal economy and everyday services, health, education, science, culture, art, credit institutions, and organs of government) [d]	14	15	18	20	22	25	29	33	37	43	48		52	56	62	68	76	82	89	97	104	112	125		142	153	165	174	184	197	211	224	240	~~258~~

[a] The series for "Total gross fixed capital (including livestock)," "Productive (including livestock)," "Industry," "Agriculture (including livestock)," "Transportation and communications," "Construction," "Nonproductive," and "Housing" were obtained as follows: actual yearend values expressed in 1973 prices for 1965, 1970, and 1975 through 1980 were obtained from *N.kh.*, 1980, p. 49. Values for 1971 through 1974 were generated by moving the aforementioned 1970 values by the index (1970 = 100) found in *N.kh., za 60 let*, 1917-77, p. 81. Values for 1966 through 1969 were derived on the basis of the methodology outlined in the appendix to this publication, using data expressed in 1969 prices from earlier issues of *N.kh.* Values for 1949 through 1965 were generated by moving the aforementioned 1965 value by the index of gross fixed capital found in C. B. Krueger, "USSR: Gross Fixed Capital Tables," revised May 1976, table 2 (processed). This index was converted to a base of 1965 = 100.

[b] Values for "Agriculture (excluding livestock)" and "(livestock)" were derived in 1973 prices as follows:
(1) The value of agricultural productive fixed capital in the socialized sector at the end of the year 1980 was 227 billion rubles (1973 prices) (*N.kh.*, 1980, p. 212, footnote).
(2) The portion of the socialized sector's productive fixed capital represented by livestock in 1980 was 10.4 percent—sum of productive and working livestock (*N.kh.*, 1980, p. 213).
(3) Therefore the value of productive livestock in the socialized sector could be computed: 227 billion rubles x .104 = 23.6 billion rubles (1973 prices).
(4) The distribution of the total value of livestock between the socialized and private sectors was calculated from inventory data in *N.kh.*, 1980, p. 245; prices of livestock (cattle - 442 rubles per head; hogs - 173 rubles per head; sheep and goats - 37 rubles per head) were obtained from Congress of the United States, Joint Economic Committee, *An Index of Agricultural Production in the USSR*, 1982, forthcoming:

	1980	
	Total Economy	Private Sector
Cattle	115.1 X 10^4 head X 442 rubles/head = 50.9 billion (1970) rubles	23.0 X 10^4 head X 442 rubles/head = 10.2 billion (1970) rubles
Hogs	73.4 X 10^4 head X 173 rubles/head = 12.7 billion (1970) rubles	14.0 X 10^4 head X 173 rubles/head = 2.4 billion (1970) rubles
Sheep and goats	147.5 X 10^4 head X 37 rubles/head = 5.5 billion (1970) rubles	30.2 X 10^4 head X 37 rubles/head = 1.1 billion (1970) rubles
Sum	69.1 billion (1970) rubles	13.7 billion (1970) rubles

Cattle, hogs, sheep, and goats make up over 90 percent of the total value of livestock holdings. For purposes of the above calculation the remaining livestock—mostly poultry and horses—were assumed to be distributed equally between the socialized and nonsocialized sectors.
(5) Therefore, the private sector's share of total livestock in 1980 was 13.7 billion rubles ÷ 69.1 billion rubles or 19.8 percent, and the socialized sector's share was 80.2 percent. Assuming this distribution in 1970 prices would not differ substantially from the distribution in 1973 prices, then the value of livestock in the total economy in 1973 prices can be derived on the basis of the value of livestock in the socialized sector derived above and the share possessed by that sector (23.6 billion rubles ÷ .802 = 29.4 billion rubles, 1973 prices).
(6) The value of livestock in the private sector is 29.4 billion rubles − 23.6 billion rubles = 5.8 billion rubles (1973 prices). Note: this implies that livestock in the private sector comprised 53 percent of total productive fixed capital in the private agricultural sector in 1980. Total private capital stock in 1980 was 11 billion rubles, 1973 prices—total agriculture productive fixed capital (238 billion rubles from table 1) minus total agricultural stock of productive fixed capital in the socialized sector (227 billion rubles from *N.kh.*, 1980, p. 212, footnote).
(7) The derived total value of livestock in 1980—29.4 billion rubles (1973 prices)—was deducted from total agricultural fixed capital (including livestock) to obtain a value for agriculture (excluding livestock) in 1980.
(8) To generate values for 1970-79, the indexes of fixed capital for agriculture (w/o livestock), found in *N.kh.*, 1980, p. 51 and *N.kh., za 60 let*, 1917-77, p. 81 (adjusted to make 1980 = 100) were moved by the 1980 value. For 1949-69 the indexes of C. B. Krueger (*op. cit.*), table 2 (adjusted to 1970 = 100) were moved by the 1970 value obtained in (7) above.
(9) Finally, "(livestock)" values for 1949-80 were estimated as the difference between "Agriculture (including livestock)" and "Agriculture (excluding livestock)." "Total gross fixed capital (excluding livestock)" and "Productive fixed capital (excluding livestock)" were derived by netting out the value of livestock.
[c] The "Trade" category was calculated as a residual: that is, "Trade" = "Productive fixed capital" − ("Industry" + "Agriculture" + "Transportation and communications" + "Construction").
[d] The "Services" category was calculated as a residual: "Services" = "Nonproductive fixed capital" − "Housing."

Table 2

Billion Rubles, 1973 Prices

Gross Productive Fixed Capital in Industry, Total and by Branch, 1959-80 [a]

	End of Year										
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total gross productive fixed capital in industry [b]	**89**	**100**	**112**	**125**	**140**	**153**	**168**	**183**	**197**	**214**	**233**
Fuels and power [c]	28.8	32.4	36.4	39.2	43.0	47.2	50.9	55.7	60.3	65.5	71.7
Electric power	13.4	15.8	18.7	20.6	22.8	25.1	27.4	30.3	33.4	37.0	40.9
Fuels	15.4	16.6	17.7	18.6	20.2	22.1	23.5	25.4	26.9	28.5	30.8
Coal [d]	NA	NA	NA	NA	NA	10.4	10.9	NA	12.0	12.4	13.0
Oil extraction [d]	NA	NA	NA	NA	NA	6.4	7.1	NA	8.3	9.0	9.8
Oil refining [d]	NA	NA	NA	NA	NA	2.8	3.2	NA	3.7	5.4	5.6
Gas [d]	NA	NA	NA	NA	NA	0.9	1.0	NA	1.4	1.3	1.4
Other fuels [e]	NA	NA	NA	NA	NA	1.6	1.3	NA	1.5	0.4	1.0
Ferrous metallurgy	9.1	10.5	12.0	13.2	14.5	15.8	17.3	18.8	20.3	22.1	24.0
Chemicals and petrochemicals	4.8	5.5	6.3	7.5	9.0	10.8	12.8	14.3	15.9	17.8	19.9
Machine building and metalworking	16.5	18.3	20.3	22.7	25.3	28.3	31.6	34.5	37.8	41.3	45.1
Construction materials	4.4	5.5	6.8	7.4	8.0	8.7	9.4	10.2	11.0	11.9	12.9
Consumer goods [f]	12.5	14.4	17.0	18.2	19.4	20.8	22.2	24.0	25.9	28.1	30.4
Light industry	4.5	5.0	5.8	6.1	6.5	7.0	7.4	8.1	8.8	9.6	10.5
Processed foods industry	8.0	9.4	11.2	12.1	12.9	13.8	14.8	15.9	17.1	18.5	19.9
Timber, woodworking, paper	4.9	5.7	6.9	7.3	7.8	8.3	8.9	9.5	10.1	10.9	11.6
Other [g]	8.0	7.7	6.3	9.5	13.0	13.1	14.9	16.0	15.7	16.4	17.4

	End of Year										
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total gross productive fixed capital in industry [b]	**255**	**278**	**301**	**326**	**354**	**385**	**416**	**445**	**480**	**514**	**551**
Fuels and power [c]	78.5	84.5	90.8	97.4	104.4	111.8	119.9	126.8	136.0	145.6	156.5
Electric power	45.0	48.6	52.6	56.2	59.8	63.8	67.9	71.5	76.0	80.5	85.4
Fuels	33.5	35.9	38.2	41.2	44.6	48.0	52.0	55.3	60.0	65.1	71.1
Coal [d]	13.8	14.2	14.9	15.6	16.3	17.3	NA	NA	NA	NA	NA
Oil extraction [d]	10.7	11.5	12.6	13.9	15.2	16.7	NA	NA	NA	NA	NA
Oil refining [d]	6.2	6.6	6.9	7.3	7.8	8.2	NA	NA	NA	NA	NA
Gas [d]	1.6	2.0	2.3	2.8	3.5	4.2	NA	NA	NA	NA	NA
Other fuels [e]	1.2	1.6	1.5	1.6	1.8	1.6	NA	NA	NA	NA	NA
Ferrous metallurgy	26.3	27.9	29.7	32.3	34.7	37.6	40.0	42.6	45.5	47.3	50.7
Chemicals and petrochemicals	22.7	25.0	27.2	30.0	32.9	35.8	39.0	41.5	45.4	50.8	55.6
Machine building and metalworking	50.8	55.9	61.5	67.6	74.7	81.8	91.0	99.1	108.7	117.9	128.6
Construction materials	14.4	15.7	17.5	19.1	20.5	22.2	23.8	25.6	27.3	28.7	30.3
Consumer goods [f]	32.5	34.9	37.7	41.0	43.9	46.7	49.8	52.5	55.6	58.6	62.3
Light industry	11.6	12.5	13.7	14.9	15.9	16.8	18.0	19.1	20.5	21.6	23.0
Processed foods industry	20.9	22.4	24.0	26.1	28.0	29.9	31.8	33.4	35.1	37.0	39.3
Timber, woodworking, paper	12.7	13.6	14.8	16.0	17.3	18.4	19.7	21.0	22.4	23.7	25.3
Other [g]	17.1	20.5	21.8	22.6	25.6	30.7	32.8	35.9	39.1	41.4	41.7

[a] The gross productive fixed capital series are derived using the branch distribution of industrial capital stock published in *N.kh.*, 1974, pp. 198-199. Base year values for 1974 expressed in 1973 prices were obtained by multiplying the shares of each industrial branch by the value of total industry capital stock for 1974 obtained from table 1. These base year values (1974 values expressed in 1973 prices) were moved by the indexes of gross productive fixed assets for the period 1970-79 published in *N.kh.*, 1975, p. 210; *N.kh.*, 1979, p. 153; and *N.kh.*, 1980, p. 141 (converted to 1974 = 100). Values for 1959-69 were obtained similarly using the growth indexes of C. B. Krueger, table 4 (converted to 1970 = 100) times the 1970 value obtained. It should be noted that the data for the period 1959-69 are compiled for all industrial enterprises. The data for 1970-79, on the other hand, include only enterprises operating on an independent balance sheet *(khozraschet)* basis—that is, those required to cover their costs and earn a profit. Since most enterprises now operate on a *khozrascher* basis, the data for the two periods are believed to be compatible.

[b] From table 1.

[c] "Fuels and power" is the sum of the "Electric power"and "Fuels" categories.

[d] Data for individual energy branches were derived as follows: (1) For 1970 through 1975, the 1974 value obtained in accordance with footnote (a) was moved by the indexes of productive fixed capital found in *N.kh.*, 1975, p. 219. Values for prior years were derived where possible by multiplying total industrial capital stock expressed in billion rubles (1973 prices) by the shares for the individual fuel branches published for 1964 in *N.kh.*, 1964, pp. 142-143; for 1965 in *N.kh.*, 1965, pp. 150-151; for 1967 in *N.kh.*, 1967, pp. 216-217; for 1968 in *N.kh.*, 1968, pp. 214-215; and for 1969 in *N.kh.*, 1969, pp. 174-175. Data for individual fuel branches has not been published since 1975.

[e] "Other fuels" is obtained as a residual; includes peat, shale, and fuelwood.

[f] "Consumer goods" is the sum of "Light industry" and "Processed foods industry."

[g] "Other" is derived as a residual. This category includes nonferrous metals, glass and porcelain, and miscellaneous other branches.

Table 3

Billion Rubles, 1973′ Prices

Gross Fixed Capital Investment by Sector of the Economy, 1960-80 [a]

	1960	1961 [b]	1962 [b]	1963 [b]	1964 [b]	1965	1966 [c]	1967 [c]	1968 [c]	1969 [c]	1970	1971 [c]	1972 [c]	1973 [c]	1974 [c]	1975	1976	1977	1978	1979	1980
Total gross fixed capital investment	**41.394**	**44.300**	**45.634**	**48.632**	**53.255**	**56.015**	**59.925**	**64.928**	**70.024**	**72.355**	**80.671**	**86.536**	**92.735**	**97.092**	**104.028**	**112.895**	**117.970**	**122.287**	**129.685**	**130.655**	**133,500**
Productive	26.882	29.295	30.119	32.590	36.668	38.864	40.743	43.890	47.728	49.707	56.120	60.903	66.165	70.465	75.972	82.984	87.154	90.207	96.595	97.233	99.186
Industry	14.838	16.375	16.366	17.420	19.571	20.620	21.197	22.538	24.258	25.144	28.526	30.010	32.152	33.914	36.312	39.712	41.594	43.454	45.603	45.685	47.280
Agriculture and forestry	5.473	6.059	6.683	7.389	8.724	9.526	10.266	11.029	12.387	12.959	14.401	16.496	18.012	19.824	21.497	23.432	24.415	25.047	26.203	26.631	27.020
Agriculture	5.440	5.962	6.541	7.215	8.585	9.477	10.090	10.769	12.015	12.517	14.276	16.430	17.984	19.856	21.579	23.293	24.266	24.908	25.787	26.344	26.850
Forestry	0.033	a	a	a	a	0.049	a	a	a	a	0.125	a	a	a	a	0.139	0.149	0.139	0.416	0.287	0.170
Transportation and communications	4.092	4.202	4.428	5.033	5.401	5.610	5.769	6.088	6.537	7.001	7.986	8.650	9.875	10.599	11.567	12.718	13.323	13.891	16.332	16.200	16.145
Construction	1.201	1.315	1.230	1.263	1.411	1.467	1.778	2.086	2.462	2.602	2.990	3.404	3.610	3.704	3.922	4.347	4.990	4.652	5.155	5.312	5.321
Trade, material and technical supplies, services, and procurements	1.278	1.344	1.412	1.485	1.561	1.641	1.733	2.149	2.084	2.001	2.217	2.343	2.516	2.424	2.674	2.775	2.832	3.163	3.302	3.405	3.420
Nonproductive	14.512	15.005	15.515	16.042	16.587	17.151	19.182	21.038	22.296	22.648	24.551	25.633	26.570	26.627	28.056	29.911	30.816	32.080	33.090	33.422	34.314
Housing	9.416	8.973	8.795	8.776	8.408	9.589	10.574	11.395	12.005	12.351	13.364	14.028	14.573	15.078	15.530	16.265	16.504	17.013	17.522	17.332	17.934
Science, education, culture, and art	2.417	2.596	2.789	2.995	3.217	3.456	3.702	4.178	4.187	4.258	4.422	4.784	4.944	4.819	5.341	5.883	6.143	6.361	6.425	6.594	6.437
Health, social insurances, physical culture, tourism, communal economy, and personal services	2.679	3.436	3.931	4.271	4.962	4.106	4.906	5.465	6.104	6.039	6.765	6.821	7.053	6.730	7.185	7.763	8.169	8.706	9.143	9.496	9.943

[a] This table presents benchmark data for 1960, 1965, 1970, and 1975-80 expressed in 1973′ prices obtained from *N.kh., za 60 let,* 1917-77, 1977, 1978, 1979, and 1980 issues and the 1977, 1978, 1979, 1980, and 1981 CEMA handbooks. Values for "Total gross fixed capital investment," "Productive" investment, and "Nonproductive" investment, and all the individual sectors except "Agriculture," "Forestry," and "Health" were obtained from the CEMA handbooks.

The "Health" values were found by subtracting "Housing" and "Science" from "Nonproductive" investment.

Values for agricultural investment are developed and discussed in table 4. This value series includes total productive investment in agriculture. It includes investment for such items as construction and equipping of livestock shelters, irrigation and drainage construction, electrification, and expenditures for tractors, transportation, agricultural machinery, and equipment. (Although not precisely parallel, this concept of investment in agriculture is close to the coverage normally used in Western countries). Three other concepts of agricultural investment are discussed and values presented (where available) in table 4.

The CEMA handbooks aggregate capital investment in the agriculture and forestry sectors into one category under the rubric "Agriculture and forestry." Since total productive investment in agriculture alone is given in annual issues of *N.kh.*, it should be possible to obtain a series of values for "Forestry" by subtracting "Agriculture" from "Agriculture and forestry." This exercise was attempted. However, for some of the nonbenchmark years, nonsensical results were obtained— probably because the data for those years had to be manipulated to convert it to 1973′ prices. Investment in forestry is so small that slight changes in "Agriculture and forestry" impact heavily on the "Forestry" residual. Therefore, values for "Forestry" are presented only for those benchmark years where data were published in 1973′ prices for all categories, that is, 1960, 1965, 1970, and 1975-80, thereby making direct comparisons possible.

[b] Calculating values for 1961-64 was difficult because the CEMA handbooks contain no data for those years.

(1) Values for "Industry," "Agriculture and forestry," "Transportation and communications," "Construction," "Housing," and "Science" for 1960-64 in 1955 prices were obtained from annual issues of *N.kh.*

(2) Using this data, an index was calculated for these sectors with 1960 = 100.

(3) This index was multiplied by the benchmark value for 1960 (in 1973′ prices) to obtain values for 1961, 1962, 1963, and 1964 expressed in 1973′ prices.

(4) Data for "Trade" are not published separately in the *N.kh.* Consequently, values for 1961 through 1964 expressed in 1973′ prices were generated by calculating the average annual rate of growth during 1961-65 using the 1960 and 1965 benchmark values as datum points. Values for 1961, 1962, 1963, and 1964 expressed in 1973′ prices were calculated on the basis of this rate of growth.

(5) "Productive investment" was calculated for each year by summing the values for the individual sectors.

(6) Values for "Nonproductive investment" for 1961, 1962, 1963, and 1964 were similarly calculated on the basis of the growth between the 1960 and 1965 benchmark values. The assumption of a steady rate of growth during this period is probably fairly realistic.

(7) "Health" was calculated as a residual: that is, "Nonproductive investment" − ("Housing" + "Science").

(8) "Total investment" in 1973′ prices for 1961, 1962, 1963, and 1964 was calculated as the sum of "Productive" and "Nonproductive" investment.

[c] Values for the years 1966-69 and 1971-74 were derived using the methodology outlined in the appendix using data published in 1969 prices found in earlier issues of the handbooks. Estimates of "Total gross fixed capital investment," "Productive" investment, and "Nonproductive" investment were estimated by summing their components.

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Table 4

Billion Rubles, 1973' Prices

Gross Fixed Capital Investment in Agriculture, 1960-80

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total capital investment by the state and collective farms in agriculture [a]	6.527	7.227	7.789	8.569	10.278	11.471	12.346	13.630	15.131	15.569	17.453	19.708	21.468	23.544	25.721	27.903	29.119	30.0	31.4	31.8	32.6
State farms	NA	3.865	4.375	5.049	6.304	7.091	7.403	8.029	8.908	9.684	10.908	12.603	13.803	15.245	16.951	18.655	19.611	20.3	21.3	21.6	22.3
Productive	NA	3.024	3.463	4.005	5.066	5.705	5.986	6.389	7.129	7.813	8.890	10.373	11.450	12.768	14.140	15.540	16.350	16.8	17.7	18.0	18.5
Nonproductive	NA	0.841	0.912	1.044	1.238	1.386	1.417	1.640	1.779	1.871	2.018	2.230	2.353	2.477	2.811	3.115	3.261	3.5	3.6	3.6	3.8
Collective farms	NA	3.362	3.414	3.520	3.974	4.380	4.943	5.601	6.223	5.885	6.545	7.105	7.665	8.299	8.770	9.248	9.508	9.7	10.1	10.2	10.3
Productive	NA	2.938	3.078	3.210	3.519	3.772	4.104	4.380	4.886	4.704	5.386	6.057	6.534	7.088	7.439	7.753	7.916	8.1	8.3	8.4	8.4
Nonproductive	NA	0.424	0.336	0.310	0.455	0.608	0.839	1.221	1.337	1.181	1.159	1.048	1.131	1.211	1.331	1.495	1.592	1.6	1.8	1.8	1.9
Total productive investment [b]	5.440	5.962	6.541	7.215	8.585	9.477	10.090	10.769	12.015	12.517	14.276	16.430	17.984	19.856	21.579	23.293	24.266	24.9	26.0	26.4	26.9
State farms	NA	3.024	3.463	4.005	5.066	5.705	5.986	6.389	7.129	7.813	8.890	10.373	11.450	12.768	14.140	15.540	16.350	16.8	17.7	18.0	18.5
Collective farms	NA	2.938	3.078	3.210	3.519	3.772	4.104	4.380	4.886	4.704	5.386	6.057	6.534	7.088	7.439	7.753	7.916	8.1	8.3	8.4	8.4
Total nonproductive investment [c]	1.087	1.265	1.248	1.354	1.693	1.994	2.256	2.861	3.116	3.052	3.177	3.278	3.484	3.688	4.142	4.610	4.853	5.1	5.4	5.4	5.7
State farms	NA	0.841	0.912	1.044	1.238	1.386	1.417	1.640	1.779	1.871	2.018	2.230	2.353	2.477	2.811	3.115	3.261	3.5	3.6	3.6	3.8
Collective farms	NA	0.424	0.336	0.310	0.455	0.608	0.839	1.221	1.337	1.181	1.159	1.048	1.131	1.211	1.331	1.495	1.592	1.6	1.8	1.8	1.9
Gross fixed investment in agriculture—entire complex of works [d]	NA	NA	NA	NA	NA	12.3	13.5	14.9	16.6	17.1	19.4	21.7	23.7	26.0	28.3	30.8	32.1	33.3	34.6	35.1	35.9
State farms	NA	NA	NA	NA	NA	7.4	7.9	8.6	9.6	10.3	11.8	13.6	14.9	16.4	18.2	20.1	21.1	22.0	23.0	23.3	24.0
Collective farms	NA	NA	NA	NA	NA	4.9	5.6	6.3	7.0	6.8	7.6	8.1	8.8	9.6	10.1	10.7	11.0	11.3	11.6	11.8	11.9
←Productive	NA	NA	NA	NA	NA	10.5	11.3	12.2	13.6	14.2	16.3	18.6	20.4	22.5	24.4	26.6	27.6	28.5	29.6	30.0	30.7 [g]
←Nonproductive	NA	NA	NA	NA	NA	1.8	2.2	2.7	3.0	2.9	3.1	3.1	3.3	3.5	3.9	4.2	4.5	4.8	5.0	5.1	5.3
Gross fixed investment in agriculture and branches supporting its development. [e] [f]																					

[a] Benchmark data expressed in 1973' prices were obtained for 1965 and 1970 through 1980 from the table entitled "Capital Investment of the State and Collective Farms in Agriculture" found in *N.kh., za 60 let*, 1917-77, p. 441; *N.kh.*, 1977, p. 357; *N.kh.*, 1979, p. 371; and *N.kh.*, 1980, p. 341. Values for "Nonproductive" investment were obtained by subtracting "Productive" investment from "Total investment." For the years 1966 through 1969 the methodology described in the appendix was used to obtain values expressed in 1973' rubles. For the years 1960 through 1964 the following procedure was followed to obtain value expressed in 1973' prices: (1) From the same table in earlier issues of *N.kh.*, data expressed in 1969 prices were collected and indexed with 1965 set equal to 100. These indexes were multiplied by the benchmark value for 1965 expressed in 1973' prices to obtain values for 1960, 1961, 1962, 1963, and 1964 expressed in 1973' prices.
(2) Values for "Nonproductive" investment were estimated by subtracting "Productive" investment from "Total investment."

[b] Gross fixed productive investment in agriculture includes investment for the construction and equipping of livestock shelters, irrigation and drainage construction, electrification, and expenditures for tractors, transportation, agricultural machinery and equipment. (Although not precisely the same, this coverage of investment in agriculture is close to that normally used in Western countries.)

[c] Gross fixed nonproductive investment in agriculture includes investment for construction of housing, schools, clubs, hospitals, and the like in rural areas.

[d] Since the beginning of the Ninth Five-Year Plan (1971-75), reports on annual plans and plan fulfillment have presented gross fixed investment in "agriculture—entire complex of works." This concept includes not only productive investment and nonproductive investment for construction of housing, schools, clubs, hospitals, and the like, but also productive and nonproductive expenditures for construction of repair enterprises, agricultural scientific-research institutions, construction-related enterprises of the Ministry of Land Reclamation and Water Resources, and enterprises (within the agricultural sector) for the processing of agricultural products. Also included are expenditures for construction work performed by kolkhoz and interkolkhoz organizations and other expenditures for the development of agriculture.
Data for 1965 and 1970-80 are from the table entitled "Capital Investment in the Development of Agriculture for the Entire Complex of Works" expressed in 1973' prices and found in the same issues of *N.kh.*, described in footnote *a*. Data for 1966-69 were generated by obtaining a value series expressed in 1969 prices for 1966-70, indexing that series by setting 1970 equal to 100 and multiplying the indexes by the benchmark values for 1970 expressed in 1973' prices to obtain values for 1966, 1967, 1968, and 1969 expressed in 1973' prices. All "Nonproductive" investment values were derived as a residual. No data are available prior to 1965.

[e] From the start of the Ninth Five-Year Plan (1971-75), an even broader concept of gross fixed capital investment in agriculture emerged—gross fixed capital investment in "agriculture and branches supporting its development." This concept includes not only gross fixed capital investment in "agriculture—entire complex of works" (discussed in footnote *d*) but also gross fixed capital investment in additions to production capacities in branches supporting agricultural development (for the most part industrial branches) and gross fixed investment in housing construction in rural areas financed with funds of collective farm members and wage and salary workers. While the category "Additions to production capacities" refers for the most part to industrial branches supplying agriculture—such as the mineral fertilizer industry, the herbicides industries, tractor, truck, and agricultural machinery industries—the category probably also includes expenditures to provide radio and telephone facilities in rural areas and expenditures for railroad, motor vehicle, and air transportation to meet the needs of rural areas. This concept is rarely mentioned in Soviet economic literature, and when mentioned its coverage is almost always ambiguous.

[f] Data unavailable.

[g] *SSSR v tsifrakh*, 1980, p. 150.

Table 5

Billion Rubles, 1973' Prices

Gross Fixed Capital Investment by Branch of Industry, 1960-80 [a]

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total gross fixed investment in industry [b]	**14.667**	**16.647**	**16.692**	**17.807**	**18.997**	**20.266**	**20.909**	**22.301**	**24.098**	**25.033**	**27.957**	**29.593**	**31.666**	**33.334**	**35.790**	**38.932**	**40.612**	**42.563**	**45.240**	**45.361**	**46.505**
Fuels and power [c]	4.407	4.771	5.170	5.612	6.104	6.646	7.023	7.224	7.336	7.370	8.221	8.899	9.350	9.688	10.285	11.143	11.629	12.189	13.615	14.031	15.350
Electric power	1.641	1.779	1.928	2.090	2.266	2.456	2.563	2.668	2.675	2.702	3.021	3.312	3.328	3.356	3.344	3.649	3.775	3.596	3.890	3.940	4.190
Fuels	2.766	2.992	3.242	3.522	3.838	4.190	4.460	4.556	4.661	4.668	5.200	5.587	6.022	6.332	6.941	7.494	7.854	8.593	9.725	10.091	11.160
Coal	1.133	1.180	1.229	1.280	1.334	1.389	1.439	1.470	1.429	1.398	1.502	1.582	1.668	1.696	1.681	1.710	1.747	1.848	2.035	2.020	2.094
Oil	1.312	1.434	1.567	1.712	1.871	2.044	2.129	2.105	2.154	2.191	2.491	2.720	2.961	3.038	3.444	3.802	4.066	4.503	5.270	5.860	6.630
Gas	0.215	0.265	0.326	0.402	0.496	0.611	0.749	0.844	0.910	0.924	1.031	1.111	1.216	1.466	1.718	1.777	1.835	2.031	2.210	2.020	2.170
Other	0.106	0.113	0.120	0.128	0.137	0.146	0.143	0.137	0.168	0.155	0.176	0.174	0.177	0.132	0.098	0.205	0.206	0.211	0.210	0.191	0.266
Ferrous metallurgy	1.386	1.457	1.532	1.610	1.692	1.779	1.689	1.933	2.197	2.087	2.021	2.132	2.297	2.744	2.931	2.805	2.907	3.059	3.030	3.210	3.070
Chemicals and petrochemicals	1.049	1.212	1.400	1.617	1.867	2.157	2.078	2.034	2.141	2.354	2.400	2.468	2.742	3.101	3.528	3.791	3.972	4.480	5.320	4.500	4.010
Machine building and metalworking	2.034	2.214	2.409	2.622	2.854	3.106	3.393	3.843	4.312	4.862	5.958	6.297	6.786	7.112	7.820	9.408	10.053	10.568	11.110	11.100	11.500
Construction materials	1.188	1.150	1.114	1.078	1.044	1.011	1.061	1.133	1.377	1.584	1.671	1.723	1.932	1.907	1.876	1.859	1.664	1.887	1.800	1.920	1.860
Consumer goods industry [d]	2.003	2.078	2.158	2.244	2.336	2.436	2.702	2.964	3.175	3.187	3.508	3.602	3.884	4.065	4.281	4.543	4.415	4.262	4.315	4.420	4.600
Light industry	0.464	0.512	0.564	0.622	0.686	0.757	0.890	1.028	1.125	1.105	1.225	1.297	1.450	1.469	1.504	1.586	1.747	1.679	1.690	1.670	1.760
Processed foods industry	1.539	1.566	1.594	1.622	1.650	1.679	1.812	1.936	2.050	2.082	2.283	2.305	2.434	2.596	2.777	2.957	2.668	2.583	2.625	2.750	2.840
Timber, woodworking, paper	0.860	0.912	0.966	1.024	1.086	1.151	1.091	1.146	1.174	1.164	1.326	1.462	1.595	1.629	1.573	1.745	1.791	1.936	1.905	1.770	1.725
Other [e]	1.740	2.853	1.943	2.000	2.014	1.980	1.872	2.024	2.386	2.425	2.852	3.010	3.080	3.088	3.496	3.640	4.181	4.182	4.145	4.410	4.390

[a] Except where indicated, data were obtained from *N.kh.*, various issues. Benchmark values for 1965, 1970, and 1975-80 expressed in 1973' prices are found in *N.kh.*, *za 60 let*, 1917-77, p. 438; *N.kh.*, 1977, p. 354; *N.kh.*, 1978, p. 344; *N.kh.*, 1979, p. 368; and *N.kh.*, 1980, p. 338. Values for 1966-69, and 1971-74, except as noted, were calculated using data expressed in 1969 prices found in earlier issues of *N.kh.*, and the methodology found in the appendix.

Values for 1960 were calculated from data in 1969 prices indexed to make 1965 the base year (1965 = 100). The indexes were multiplied by the benchmark values for 1965 to obtain values for 1960 expressed in 1973' prices.

Because data could not be found for the years 1960 through 1965 in a consistent set of prices, values for 1961 through 1964 for all sectors, except as noted, were generated by calculating the average annual rate of growth of investment expenditures in 1973' prices between 1961 and 1965 using 1960 and 1965 as datum points. Values for 1961, 1962, 1963, and 1964 expressed in 1973' rubles were calculated on the basis of these rates of growth.

[b] The values for "Total industry investment" shown in this table differ slightly from the values shown for "Industry" in table 1 because expenditures of collective farms on the construction of industrial enterprises are excluded from the data in table 5. In 1980, collective farms spent about 0.775 billion rubles (1973' prices) on the construction of such enterprises.

[c] The "Fuels" category was obtained differently from the other sectors because the *N.kh.* does not publish a "Fuels" total. "Fuels" benchmark values for 1960, 1965, 1970, and 1975-79 expressed in 1973' prices were found in 1977, 1979, 1980, and 1981 CEMA handbooks, capital investment sections. Values for 1966-69 and 1971-74 were constructed from earlier data expressed in 1969 prices found in the CEMA handbooks, using the methodology described in the appendix to obtain values for 1966, 1967, 1968, 1969, 1971, 1972, 1973', and 1974 expressed in 1973' prices.

The "Fuels" industry values were then used as a control total; that is, these data were assumed comparable with the *N.kh.* data for the individual branches of the fuels industry. "Coal," "Oil," and "Gas" sector investment data are published in the *N.kh.*, and these values were constructed similar to the other industrial sectors described. For all years except 1961-64, "Coal," "Oil," and "Gas" were netted out of "Fuels" to obtain investment in "Other" fuel industries. These include peat, shale, and fuel wood. To set up a more stable data series, values for the "Other" fuels category for 1961-64 were generated by calculating the growth during 1961-65 using 1960 and 1965 as datum points. Values for 1961, 1962, 1963, and 1964 expressed in 1973' rubles were calculated on the basis of this rate of growth. For these years, all branches of the fuel industry were summed to obtain 1961, 1962, 1963, and 1964 values for total "Fuels" expressed in 1973' rubles.

The "Fuels and power" total was calculated for all years by summing "Electric power" and "Fuels."

[d] "Consumer goods industry" for all years was calculated by summing "Light industry" and "Processed foods industry."

[e] The "Other" category for all years was calculated as a residual. It includes the nonferrous metals industry, glass and porcelain industry, and other miscellaneous industrial branches.

Table 6

Other Published Statistics

Billion Rubles

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Gross additions to capital [a] (1973′ prices)	37.5	38.1	42.7	46.6	49.5	51.4	55.0	59.6	61.6	66.6	76.4	81.3	83.9	92.8	97.2	105.6	107.1	110.5	120.1	120.1	~~130.2~~ 132
Utilization of national income for accumulation [b] (current prices)																					
Growth of fixed assets	25.3	25.3	28.4	28.2	28.9	27.9	29.7	31.8	34.0	40.0	51.1	57.7	55.2	60.2	62.0	61.2	NA	NA	NA	NA	NA
Productive	15.7	15.6	18.2	17.4	19.2	17.5	18.9	19.4	20.7	25.5	32.1	33.5	34.7	39.0	40.9	38.8	NA	NA	NA	NA	NA
Nonproductive	9.6	9.7	10.2	10.8	9.7	10.4	10.8	12.4	13.3	14.5	19.0	20.2	20.5	21.2	21.1	22.4	NA	NA	NA	NA	NA
Unfinished construction [c] (current prices)																					
Total economy	21.4	24.8	26.1	26.2	27.1	29.6	32.5	35.8	41.8	48.6	52.5	57.9	65.2	67.1	71.7	76.7	84.1	92.5	99.0	106.4	105.1
Productive	15.1	17.9	19.5	20.0	21.3	23.5	25.3	27.5	31.5	35.9	39.3	43.3	49.0	50.8	54.6	58.6	64.3	71.4	76.2	82.0	80.8
Industry																					
Electric power	1.4	1.5	1.7	1.6	1.9	2.1	2.4	2.6	2.6	2.9	3.1	3.5	3.6	3.9	3.9	4.1	4.2	4.6	5.0	5.5	5.5
Coal	1.2	1.3	1.3	1.3	1.3	1.5	1.6	1.7	1.8	2.0	2.0	2.1	2.4	2.4	2.3	2.2	2.3	2.7	2.9	2.8	2.8
Oil and gas	1.1	1.6	1.7	1.5	1.8	2.1	2.3	2.5	2.5	2.8	3.1	3.6	4.1	4.5	4.8	5.2	5.7	6.3	6.8	7.5	7.8
Ferrous metallurgy	0.9	1.3	1.5	1.4	1.3	1.6	1.5	1.7	2.2	2.4	2.2	2.6	3.0	3.0	3.5	3.4	3.7	4.1	4.0	5.0	4.3
Chemicals	1.0	1.3	1.5	1.6	2.1	2.3	2.5	2.6	2.7	3.1	2.9	3.0	3.5	3.7	4.5	5.0	5.7	7.5	9.2	8.9	7.6
Machine building and metalworking	1.5	1.8	2.1	2.1	2.2	2.5	2.6	2.9	3.4	4.3	4.9	5.4	6.3	6.9	7.5	8.9	8.8	9.5	9.9	10.7	10.5
Wood and woodworking	0.6	0.8	0.8	0.9	1.0	1.1	1.1	1.0	1.1	1.1	1.1	1.3	1.4	1.5	1.6	1.7	1.8	2.1	2.1	2.3	1.9
Construction materials	0.8	—	—	1.1	1.1	1.0	1.0	1.1	1.3	1.5	1.4	1.5	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9
Light industry	0.3	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.8	0.9	0.8	0.9	0.9	1.1	1.1	1.0	1.0	~~97.0~~ 98
Food industry	0.9	1.0	1.0	1.1	1.1	0.9	1.1	1.2	1.4	1.6	1.7	1.8	1.9	1.8	1.9	1.9	2.1	2.1	2.2	2.3	2.3
Nonproductive [d]	6.3	6.9	6.6	6.2	5.8	6.1	7.2	8.3	10.3	12.7	13.2	14.6	16.2	16.3	17.1	18.1	19.8	21.1	22.8	24.4	24.3

[a] Benchmark values for 1965 and 1970-80 were obtained from *N.kh., za 60 let*, 1917-77, p. 423; *N.kh.*, 1979, p. 357; and *N.kh.*, 1980, p. 327. Earlier year values were obtained as follows: A value series expressed in 1969 prices was available from earlier issues of *N.kh.* for the period 1961-70; values for 1966-69 were constructed using these data and the methodology described in the appendix; values for 1961-64 were constructed from the *N.kh.* data expressed in 1969 prices by constructing an index with 1965 = 100 and multiplying it by the benchmark value for 1965 expressed in 1973′ prices to obtain values for 1961, 1962, 1963, and 1964 expressed in 1973′ prices; finally, for 1960, values for gross additions to capital (commissionings) expressed in 1962 prices were found in *N.kh.*, 1965, p. 521. The series was indexed with 1965 = 100 and multiplied by the benchmark value for that year expressed in 1973′ prices to obtain a value for 1960 expressed in 1973′ prices.

[b] Source: *N.kh.*, various issues; section entitled "Utilization of National Income for Consumption and Accumulation," as found, for example, in *N.kh.*, 1975, pp. 565-568. Values are expressed in current prices.

[c] Source: *N.kh.*, various issues; table entitled "Unfinished Construction of State and Cooperative Enterprises and Organizations According to Individual Branches of Industry." The value of unfinished construction of collective farms is not included. Values are expressed in current prices.

[d] The "Nonproductive" category is calculated as a residual, by subtracting the value of "Productive unfinished construction" from total "Unfinished construction."

Other Published Statistics. The Central Statistical Administration also publishes (or has published) statistics on "gross additions to capital" *(vvod v deystviye osnovnykh fondov)*, growth in fixed capital, and "unfinished construction" *(nezavershennoye stroitel'stvo)*.

The category "gross additions to capital" (commissionings) in a given year is defined as including: the value of additional enterprises, buildings, and installations, completed and put in service, for both productive and nonproductive purposes; the value of all equipment types put into service (whether requiring installation or not); the value of additional production tools, implements and other manufactured articles; the value of additions to perennial plantings (orchards, vineyards, and so on); the cost of work done to irrigate and drain land; the cost of dredging operations and bog preparation; the value of new commercial petroleum and gas-producing wells and exploratory wells that meet specified requirements for petroleum or gas flow; and other outlays augmenting the value of fixed assets.

As part of its presentation of national income statistics in current prices, the Central Statistical Administration published from 1958 to 1975 values for the growth of productive and nonproductive fixed capital as part of "accumulation." The definition of the change in the value of fixed assets in these series differs from the definitions that apply to commissionings or the change in the series of fixed capital in comparable prices. Growth in fixed assets is equal to new fixed investment plus capital repairs less depreciation and retirements.

"Unfinished construction" refers to construction and installation work under way but not finished to the point of permitting use of these assets. It includes equipment in the process of being installed or actually in place in uncompleted structures.

Consistency of the Published Data. In theory, the statistical series presented in this report should be consistent with each other. For example, the relationship between Soviet investment expenditures, unfinished construction, and the value of the capital stock should be the following:

$$(1)\ K_t = K_{t-1} + I_{g_t} - R_t + (UC_{t-1} - UC_t)$$

where:

K_t = Capital stock in operation at the end of year t

K_{t-1} = Capital stock in operation at the end of year t − 1

I_{g_t} = Gross fixed capital investment in year t

R_t = The value of capital stock retired in year t

UC_t = The value of unfinished construction at the end of year t

Also, gross additions to capital should be related to the value of the capital stock as follows:

$$(2)\ K_t = K_{t-1} + C_t - R_t$$

where:

C_t = Gross additions to capital (commissionings) in year t

It follows, therefore that:

$$(3)\ C_t = I_{g_t} + (UC_{t-1} - UC_t)$$

In reality, however, the data are not compatible. Inconsistencies may arise, for instance, because of differing price bases used to construct the various published series. The unfinished construction data are given in current prices, while the capital stock data are published in constant 1973 prices. Investment data, on the other hand, include machinery and equipment expenditures valued in 1973 prices and construction costs expressed in 1969 estimate prices, with account taken of adjustments made to construction norms promulgated in 1976.

In addition, some portion of investment expenditures does not result in either commissioned capacity or unfinished construction. For example, some new fixed capital investment expenditures such as for drilling activity and some incidental outlays—land surveys,

personnel training, and the like—are not assignable to fixed capital (and thus are not reflected in commissionings).

On the other hand, official new fixed capital investment data do not include all new fixed capital investment expenditures for the year. Outlays for equipment for state law institutions, schools, hospitals, kindergartens, and nurseries are omitted although these excluded expenditures do appear in official commissionings data for the year.

Finally, even though official investment and commissionings data reflect collective farm investment and commissionings, the unfinished construction series does not cover the backlog of unfinished projects financed from collective farm investment. Conceivably there could be annual change in this backlog.

Equation (3) was used to test the compatibility of published statistical series. If the data are totally consistent, the expression should hold. We found, however, that when the data for total fixed investment, total fixed capital, and unfinished construction in the economy were substituted into the expression the equality did not hold in any year during the period (see table 7). Still, the ratio of the left side of the equation to the right ranged only from 0.93 to 1.02 and averaged 0.97. Moreover, since 1971 it has been practically constant. We concluded, therefore, that despite the problems discussed, the data are reasonably consistent and reliable.

A second means of testing the published series for consistency is to use the data to calculate annual retirement rates for the Soviet capital stock and compare the results with retirement rates published by Moscow. Two variants were tried. Variant I was obtained by solving for R_t in equation (1), and variant II by solving for R_t in equation (2). The results are presented in table 8.

The average retirement rate of the Soviet capital stock during the period 1961-80 ranged between 1.5 percent annually (variant II) and 1.7 percent annually (variant I). Such rates are low, particularly relative to retirement rates in the industrial West. The US Department of Commerce estimates, for example, that the overall stock of equipment and structures in the United States was retired at an average annual rate of 3.7 percent during 1961-80 and industrial equipment and structures at 4.2 percent annually.

Table 7

Testing the Consistency of Soviet Data on Capital Formation for the Economy as a Whole

Year	I_g	(UC_{t-1}) $-UC_t$	Columns (1)+(2)	C_t	Columns (4)÷(3)
	(1)	(2)	(3)	(4)	(5)
1961	44.3	−3.4	40.9	38.1	.93
1962	45.6	−1.3	44.3	42.7	.96
1963	48.6	−0.1	48.5	46.6	.96
1964	53.3	−0.9	52.4	49.5	.94
1965	56.0	−2.5	53.5	51.4	.96
1966	59.9	−2.9	57.0	55.0	.96
1967	64.9	−3.3	61.6	59.6	.97
1968	70.0	−6.0	64.0	61.6	.96
1969	72.4	−6.8	65.6	66.6	1.02
1970	80.7	−3.9	76.8	76.4	.99
1971	86.5	−5.4	81.1	81.3	1.00
1972	92.7	−7.3	85.4	83.9	.98
1973	97.0	−1.9	95.1	92.8	.98
1974	104.0	−4.6	99.4	97.2	.98
1975	112.9	−5.0	107.9	105.6	.98
1976	118.0	−7.4	110.6	107.1	.97
1977	122.3	−8.4	113.9	110.5	.97
1978	129.7	−6.5	123.2	120.1	.975
1979	130.76	−7.4	123.3	120.1	.974
1980	133.57	+1.3	~~134.8~~ 135.0	~~130.2~~ 132.0	.978
1981	138.8	−2.9	135.9	132.6	.976
1982	141.7	−0.1, +0.5	141.6 − 142.2	138.5	.974−.978

The Soviets publish retirement rates for total industry and by branch of industry but not for the total capital stock in the economy. For total industry the published rates have ranged from 1.1 percent to 2.1 percent since 1965 and, in general, are slightly higher than the rates we calculated. However, because the machinery component should be higher in industry than in the total economy and machinery tends to wear out more quickly than structures, *a priori*, one would expect the industrial retirement rate to be higher. In general, the calculated retirement rates for the overall capital stock were of the same order of magnitude as

Table 8

Billion Rubles

Estimating Retirement Rates of Soviet Fixed Capital Stock

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Variant I [a]										
Value of fixed capital stock retired	5.9	6.3	6.5	9.4	8.5	13.0	15.6	15.0	10.6	11.8
Retirement rate (percent) [b]	1.6	1.5	1.4	1.9	1.6	2.2	2.5	2.2	1.5	1.5
Variant II [c]										
Value of fixed capital stock retired	3.1	4.7	4.6	6.5	6.4	11.0	13.6	12.6	11.6	11.4
Retirement rate (percent) [b]	0.9	1.1	1.0	1.3	1.2	1.9	2.2	1.9	1.6	1.5
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Variant I [a]										
Value of fixed capital stock retired	12.1	8.4	17.1	13.4	21.9	21.6	21.9	23.2	23.3	27.8
Retirement rate (percent) [b]	1.4	0.9	1.7	1.3	1.9	1.8	1.7	1.6	1.5	1.7
Variant II [c]										
Value of fixed capital stock retired	12.3	6.9	14.8	11.2	19.6	18.1	18.5	20.1	20.1	23.2
Retirement rate (percent) [b]	1.5	0.8	1.5	1.1	1.7	1.5	1.4	1.4	1.3	1.4

[a] Calculated on the basis of the following relationship: $K_t = K_{t-1} + I_g - R_t + (UC_{t-1} - UC_t)$ where K_t and K_{t-1} are the values of the fixed capital stock in the USSR in periods t and t−1, respectively, I_g is gross fixed capital investment in period t, R_t is the value of the capital stock retired in period t, and UC_t and UC_{t-1} are the values of unfinished construction in periods t and t−1, respectively.

[b] Calculated by dividing the value of fixed capital stock retired in year t by the total value of fixed capital stock (excluding livestock) on hand on 31 December of the previous year.

[c] Calculated on the basis of the following relationship: $K_t = K_{t-1} + C_t - R_t$ where K_t and K_{t-1} are the values of the fixed capital stock in the USSR in periods t and t−1, respectively, C_t is the value of the gross additions to fixed capital in period t (commissionings), and R_t is the value of the fixed capital stock retired in period t.

the published rates for Soviet industry. The results lend credence, therefore, to our earlier finding that the published data appear generally consistent.

The practice of keeping plants and equipment in operation for protracted periods is probably a major contributor to the general inefficiency that plagues the Soviet economy. The high proportion of aged capital stock that has resulted from such low retirement rates requires large expenditures for maintenance and capital repairs and reduces the productivity of both labor and capital resources throughout the economy.

Inflation and Soviet Investment Statistics. A controversy has recently arisen over the impact of inflation in the USSR on the official investment statistics. The main concern, voiced principally by Alec Nove, is that large inflationary increases in machinery and construction prices are not captured in Soviet price indexes—that is, these indexes are strongly biased downward. Deflation of investment data in current prices by these price indexes causes the published investment statistics to be overstated, perhaps misleading both Soviet planners who manage investment resources and Western economists who use these data to analyze various aspects of the Soviet economy, such

as productivity of capital. Nove maintains that, in fact, because of inflation investment costs have been rising rapidly.[7]

Stanley Cohn and Peter Wiles, on the other hand, argue that Nove has exaggerated the impact of inflation on Soviet investment data. First, according to Cohn, the Soviets deflate investment data not by an index that suffers from the downward bias of official price indexes but more realistically by so-called estimate price indexes that reflect costs of investment projects combining particular bundles of machinery and construction. In other words, the investment deflator is not based on unchanging, unrepresentative samples as is the machinery price deflator so that the production of investment goods is not overstated. Cohn's own analysis indicates that the likely upward bias in the investment data "is less than 1 percent per year." [8]

Both Cohn and Wiles, furthermore, argue that Nove has confused declining productivity of investment with inflation. That is, the rapidly increasing costs of commissioning new capacity in the Soviet Union mainly reflect an increase in the amount of capital assets required to mine, process, and transport a given amount of output rather than increasing prices of capital goods. Various factors are responsible for the rising trend in the cost per unit of output produced, including:

- The increasing dependence of the Soviet economy on the Siberian areas of the country for fuels and raw material resources. Developing these new resource areas requires heavy capital investment in both basic facilities for exploration and exploitation as well as for social overhead capital.

- The declining quality of readily available raw materials from the more "traditional" locations in European Russia. As lower quality resources are being extracted from more distant, less hospitable locations, capital costs have been rising more rapidly than output.

Wiles also attempted to measure the rate of price inflation in investment goods. He estimates that the rates of domestic cost inflation during 1966-76 were 2 percent a year for the machinery component of investment and 2.5 percent a year for industrial construction.

Our own research found inflation in machinery prices to be quite low. Analysis of eight types of machinery items, for example, indicated a 7- to 11-percent annual rate of increase in the prices of so-called new products during 1967-73.[9] The overall rate of inflation in machinery prices including established or unchanged models, however, was found to have been almost negligible. Moreover, a comparison of the trend in the official series for investment in machinery and equipment (adjusted to a production basis and modified for exports and imports) with the trend in CIA's index of production of producer durables shows that the two series grew at about the same rate during 1950-80. The CIA's producer durables index itself probably overstated machinery growth by a maximum 1.2 percentage points per year, according to one

Comparison of Soviet and CIA Measures of Producer Durables Production

Average Annual Percentage Growth

	USSR: Adjusted Investment in Machinery	CIA: Producer Durables Production
1951-60	12.3	12.1
1961-70	8.6	8.3
1971-79	7.3	7.6
1951-79	9.5	9.4

[7] A. Nove, "A Note on Growth, Investment, and Price-Indices," *Soviet Studies*, vol. XXXIII, No. 1 (January 1981), p. 143.

[8] See Stanley H. Cohn, "A Comment on Alec Nove, 'A Note on Growth, Investment and Price Indexes,'" *Soviet Studies*, vol. XXXIII, No. 2 (April 1981), pp. 296-299, and Peter Wiles, "Soviet Consumption and Investment Prices, and the Meaningfulness of Real Investment," *Soviet Studies*, vol. XXXIV, No. 2, (April 1982), pp. 289-295.

[9] These results are based on a sample containing only new products—that is, the sample included individual model prices only once, the first year they appeared in the data base. With established models also included in the sample, the rate of inflation was much less. Therefore, the measurement of inflation is accurate only to the extent that the sample included the proper mix of established and new models. See Robert E. Leggett, "Measuring Inflation in the Soviet Machinebuilding Sector, 1960-1973," *Journal of Comparative Economics* (June, 1981), pp. 169-184.

estimate.[10] Annual inflation in that part of the machinery and equipment component of investment that is of domestic origin would then be about 1 percent.

Investment in machinery, however, also reflects imported machinery and equipment. How the rising prices that the USSR pays for such machinery influence reported investment in constant prices is pretty much a mystery. One careful study of Soviet foreign trade prices concludes that imports of machinery are not deflated by the Central Statistical Administration—when it compiles national income accounts in constant prices.[11] Whether this approach also applies to investment statistics is not known. In any event, the possible impact on investments of inflation in the prices of machinery purchased abroad can be assessed roughly. First, imported machinery accounted for at most about 10 percent of investment in machinery over the last 20 years. Second, according to Soviet calculations, prices on imported machinery rose by 6 percent per year in the 1970s, which is certainly a faster rate of inflation than obtained in the 1960s. If all of the inflation in imported machinery found its way into investment in constant prices, the inflation in the investment series would be a weighted average of inflation in the prices of domestically produced machinery (assume 1 percent per year from the preceding discussion) and inflation in the prices of imported machinery (6 percent per year at the outside). The weighted average of the two inflation rates is 1.5 percent per year.

A rough estimate of the amount of potential inflation in the construction-installation component of new fixed investment can also be calculated from a comparison of the official index of construction installation work with an index of inputs into construction compiled by CIA.[12] The construction installation index rises about 1 percent per year faster than the index of construction inputs; the difference can be tentatively used as an approximation of the maximum inflation in the official construction installation work series.

To test the effects of plausible rates of hidden or unrecorded inflation on the capital stock indexes, Soviet capital stock values since 1960 were simulated through a series of calculations beginning with "deflated" values for commissionings and retirements. Alternative investment price deflators that bracket the rates of inflation discussed here were constructed assuming 1-percent and 2-percent inflation (1973 = 100).[13] Then commissionings and retirements were deflated individually and new values for fixed capital were calculated.

Somewhat surprisingly, the deflated series grows more rapidly than the official series.

Average Annual Percentage Growth in Fixed Capital (1973 prices)

	1961-80	1961-70	1971-80
Officially reported	7.9	8.3	7.4
Adjusted for 1-percent hidden inflation	8.2	9.0	7.4
Adjusted for 2-percent hidden inflation	8.9	10.7	7.1

It turns out that the deflation raises the value of commissionings in the 1960s relative to the value of commissionings in the 1970s. Consequently, increments to the capital stock are relatively larger in the 1960s than in later years in the deflated series, and, therefore, the rate of growth of the capital stock in the 1960s is greater in the deflated than in the official series. (Retirement values when deflated are also higher in the 1960s than in the 1970s. But since they

[10] Ray Converse, *An Index of Industrial Production in the USSR* (Washington, D.C., Joint Economic Committee, Congress of the United States, forthcoming). About 60 percent of the producer durables index is based on series in value terms. Therefore, the index is almost certainly not totally free of the effects of inflation.
[11] US Bureau of the Census, "The Domestic Value of Soviet Foreign Trade: Exports and Imports in the 1972 Input-Output Table," forthcoming.
[12] See, for example, Rush V. Greenslade, "The Real National Product of the U.S.S.R., 1950-75," *Soviet Economy in a New Perspective*, Joint Economic Committee of the US Congress, 1976, pp. 292-294.

[13] The values for gross commissionings (excluding livestock) were taken from table 6. Retirements were calculated as the differences between gross commissionings and the changes in gross fixed capital (excluding livestock) found in table 1. Gross commissionings in the year were deflated by the investment price deflator for year t−5 to take into account construction lags, and retirements in year t were deflated by the investment price deflator for year t−20, assuming an average service life of 20 years.

are smaller than commissionings, the net effect is still to raise the value of increments in fixed capital in the early years relative to increments in later years). By the late 1970s, however, deflated growth in fixed capital is less than the officially reported growth, and this divergence would increase in the 1980s under the assumed rates of hidden inflation.

Appendix

Converting Data From One Price Base to Another

The series shown for Soviet gross fixed capital stock and gross fixed capital investment are expressed in constant prices—the capital stock series is expressed in constant 1973 rubles and the capital investment series in constant 1973 rubles. Since in each case a complete series is not available in the same price in the statistical handbooks, a method had to be devised to convert data expressed in one price base to another.

The method used is that used by Gillula to construct fixed capital stock data series in 1973 prices for the Soviet republics.[14] For explanatory purposes, the conversion of fixed capital stock data expressed in 1969 prices to a 1973-price-based series is described. The general procedure, however, can be used to transform any series in one set of prices into a series expressed in a different price base.

Assume that values for fixed capital stock expressed in constant prices is desired for the period 1970-80. Moreover, assume that data expressed in 1973 rubles are available only for the years 1970 and 1975-80 and that capital stock data in 1969 rubles are available for the period 1970-75.

A reasonable approximation of the values of fixed capital in 1973 prices for the period 1971-74 can be derived by calculating growth indexes from the capital stock data in 1969 prices and applying them to the benchmark values for 1970 and 1975 in 1973 prices. As Gillula points out, an index calculated in 1969 prices may differ from an index calculated in 1973 prices because of (1) differences in the relative prices of assets in the two years and (2) changes over time in the intrabranch composition of fixed assets. These differences should be taken into account in estimating the 1973-price-based series.

[14] James W. Gillula, "Fixed Capital in Soviet Republics in 1973 Prices: 1960 to 1979," Working Paper, Foreign Demographic Analyses Division, US Bureau of the Census, October 1981.

One way to account for such differences is to first construct an index of the growth of fixed capital in 1969 prices between 1970 and 1975:

$$(1) \quad G_{69} = \frac{K_{69}^{1975}}{K_{69}^{1970}}$$

Where, for example, K_{69}^{1975} is the ruble value of the capital stock in 1975 expressed in 1969 prices.

This index of growth (G_{69}) is equal to the product of the five annual average rates of growth in 1969 prices during the period 1970-75:

$$(2) \quad G_{69} = g_{69}^{1971} \cdot g_{69}^{1972} \cdot g_{69}^{1973} \cdot g_{69}^{1974} \cdot g_{69}^{1975}$$

Since growth in 1969 prices is not the same as growth in 1973 prices:

$$(3) \quad G_{69} \neq G_{73}$$

adjustment is necessary. Gillula's adjustment is to multiply both sides of equation (2) by the ratio G_{73}/G_{69}, which gives:

$$(4) \quad G_{73} = \frac{G^{73}}{G^{69}} (g_{69}^{1971} \cdot g_{69}^{1972} \cdot g_{69}^{1973} \cdot g_{69}^{1974} \cdot g_{69}^{1975})$$

This adjustment can be distributed equally among the five terms in the parentheses by using a factor α defined as follows:

$$(5) \quad \alpha = \sqrt[5]{\frac{G_{73}}{G_{69}}}$$

Values for the individual years 1971 through 1974 expressed in 1973 prices can then be calculated as follows:

(6) $K_{73}^{1971} = \alpha \cdot g_{69}^{1971} \cdot K_{73}^{1970}$

$K_{73}^{1972} = \alpha \cdot g_{69}^{1972} \cdot K_{73}^{1971}$

$K_{73}^{1973} = \alpha \cdot g_{69}^{1973} \cdot K_{73}^{1972}$

$K_{73}^{1974} = \alpha \cdot g_{69}^{1974} \cdot K_{73}^{1973}$